CHASSIS Lubricate for SAFETY every 1,000 MILES LUBRICATION

The Institute Spokesman

Published by the NATIONAL LUBRICATING GREASE INSTITUTE

VOLUME III • NUMBER 6 SEPTEMBER, 1939

*The Chrysler Fluid Drive**

By E. R. MAURER, Chief Engineer of the Chrysler Division, Chrysler Corporation, Detroit, Michigan.

The Chrysler Corporation introduced the Fluid Drive on its 1939 line of Chrysler Custom Imperial cars. The Fluid Drive principle has been familiar to the engineering profession, in a number of different applications, for at least thirty years, but up to this time has been used on only the higher priced European passenger cars. The Chrysler Fluid Drive, unlike its foreign predecessors, is made of steel stampings and forgings, welded together into a single compact unit.

The principle of transfer of energy through the medium of oil in the Fluid Drive unit is similar to the principle involved when one electric fan connected to a source of electrical current, causes the blades of a second fan to rotate, the second fan being placed so as to face the first fan, about 2 in. apart, and not being connected to the electrical current. Air carries energy from the first fan to the second fan, and causes its blades to rotate even though the two fans are not mechanically connected. In the actual unit the driving fan or impeller is attached to the crankshaft, and consists of a forged steel hub and a stamped steel housing with fins welded to the inner forward, or crankshaft, side of the housing. The driven fan, or runner, is mounted facing the impeller and spaced ½ in. from it. This runner is likewise a steel stamping to which are welded fins, the whole runner stamping assembly being welded to a forged steel hub, which is free to rotate in its antifriction bearing mountings. There is no mechanical connection, therefore, between these two elements, the drive through the unit being solely through the medium of a light, highly refined mineral oil with which the housing is filled to four-fifths of its capacity. The remaining space is left for expansion of the fluid. A bellows-type seal between the runner and the impeller housing retains the oil in the unit.

* Copyright Chek-Chart, Inc. Reproduction forbidden.

In operation, the oil is given motion by the impeller and is thrown outward by centrifugal force onto the fins of the runner, imparting a turning force to the runner. The oil being confined, follows a circular path similar to a stripe on a barber pole which has been formed into a doughnut-shape.

The flow of power through the Fluid Drive is smooth and vibrationless, and has made possible a sensational new experience in motoring which has occasioned much discussion.

Following is a list of frequently asked questions concerning the Fluid Drive, together with their answers:

Questions and Answers on Chrysler Fluid Drive

1. Q. Doesn't the slip in the Fluid Drive mean a generation of heat and cause the unit to become very hot?
   A. Under all ordinary driving conditions the oil in the Fluid Drive becomes no hotter than the oil in the crankcase of the engine. The natural circulation of air over the unit keeps it from overheating. Of course, it is possible to overheat the unit by abuse, as by wide open throttle operation with the car in gear, the clutch engaged, and the car standing still. Even under such deliberate abuse, however, the slight film of oil on the parts in the vicinity of the Fluid Drive will give off smoke and odors to warn the operator at a temperature considerably below that at which damage might possibly be done to the unit. Such an oil film is always present on the under parts of any car. The clutch in a standard car may be completely ruined in a very short time by abuse, such as slipping it under heavy load and high speed. Even under comparable abuse, however, the Fluid Drive has a much greater factor of safety, and the operator has ample warning before any possible damage might be done.
2. Q. Since there is always a slip in the Fluid Drive isn't there a marked increase in gasoline consumption over a standard car?
   A. No. Exhaustive comparative tests under all conceivable driving conditions have shown that the overall difference in economy between a standard car and a car equipped with a Fluid Drive is so slight as to be negligible. The difference is less than the variation in fuel consumption on the same car with different drivers. When a car equipped with Fluid Drive is started in traffic, in high gear, there is no racing of the engine in each gear as the car gains headway, as in a standard car started through the gears. Also, in a standard car, every time a change of gears is made, and the accelerator pedal depressed, a shot of gasoline is sent to the engine by the accelerating pump. In a Fluid Drive car, this occurs only once, as opposed to three times in a stand-

(Continued on page 3)

OFFICERS AND DIRECTORS

President: M. R. BOWER, Standard Oil Company of Ohio. *Vice-Pres. and Treas.:* E. V. MONCRIEFF, Swan-Finch Oil Corporation
Executive Secretary: G. W. MILLER, Battenfeld Grease & Oil Corp. of N. Y.

DIRECTORS

J. R. BATTENFELD, Battenfeld Grease & Oil Corp.
J. R. CORBETT, Cato Oil & Grease Co.
L. P. LOCHRIDGE, Sinclair Refining Company
F. J. SNYDER, Fiske Bros. Refining Company
W. E. CALLAGHAN, Motor State Oil & Grease Co.
C. B. KARNS, Standard Oil Company of N. J.
WM. H. OLDACRE, D. A. Stuart & Company
B. C. VOSHELL, Socony-Vacuum Oil Co., Inc.
M. B. CHITTICK, Pure Oil Company
F. C. KERNS, The Texas Company
WM. H. SAUNDERS, JR., International Lubricant Corp.
R. H. PATCH, E. F. Houghton & Co.

Program — 7th Annual Convention

of the

NATIONAL LUBRICATING GREASE INSTITUTE

MONDAY, OCTOBER 2, 1939
REGISTRATION 9:00 TO 10:00 A. M.
OPENING 10:00 A. M.

ADDRESS OF WELCOME
M. R. Bower, *President*

ADDRESS
Mr. J. W. Saybolt, *President*, Penola, Inc.

MODERN EQUIPMENT FOR THE PROPER APPLICATION OF INDUSTRIAL GREASES
Mr. A. J. Jennings, *General Sales Mgr.*, The Farval Corp.

SUPER FINISH AND ITS RELATION TO LUBRICATION
Mr. D. A. Wallace, *President Chrysler Division*, Chrysler Corp.

AUTOMOTIVE LUBRICATION EQUIPMENT
Mr. Foster Holmes, *V. Pres. Charge of Sales*, Lincoln Engineering Co., St. Louis, Mo.

USE OF SYNTHETIC FATS IN GREASE MANUFACTURE
Dr. D. A. Burwell, Alox Corporation, Niagara Falls, N. Y.

PROGRESS OF LUBRICATION IN THE STEEL MILLS
Mr. C. C. Pecu, *Lubrication Engineer*, Bethlehem Steel Corp.

INDUSTRIAL TRADE ASSOCIATIONS, THEIR FUNCTION & RESPONSIBILITY
Mr. J. E. Moorhead, *Executive Secretary*, Penna. Grade Crude Oil Association

THE NEW INDUSTRIAL FRONTIER — HUMAN RELATIONSHIPS
Mr. A. A. Nichoson, *Manager Personnel Dept.*, The Texas Co., New York City

FATS & THEIR USE IN GREASE MANUFACTURE
Armous & Co., Chicago, Ill.

VARIOUS METHODS OF APPLYING LUBRICANTS
Mr. James I. Clower, *Associate Professor Machine Design*, Virginia Polytechnic Institute

HYPOID GEAR LUBRICATION
Mr. A. O. Willey, C. S. Prutton, Lubri-Zol Sales Corp., Cleveland, Ohio

A. J. ("Dad") STEVENS' CONTRIBUTIONS TO THE MANUFACTURE AND PROGRESS OF LUBRICATING GREASES
Mr. Ralph R. Matthews, Battenfeld Grease & Oil Corp., Kansas City, Mo.

LUBRICATING GREASE NOMENCALTURE RELATED TO USE
Mr. Raymond Shaw, *President*, Chek-Chart Corp., Chicago

PERSONAL "UP TO THE MINUTE" IMPRESSIONS ABROAD
Mr. J. R. Battenfeld, *President*, Battenfeld Grease & Oil Corp.

MONDAY EVENING ANNUAL DINNER

TOWER BALL ROOM — 7:00 P. M.
(ENTERTAINMENT — NO SPEECHES)

STEVENS HOTEL - CHICAGO, ILL.

OCTOBER 2-3, 1939

The
INSTITUTE SPOKESMAN

Published Monthly by THE NATIONAL LUBRICATING GREASE INSTITUTE

GEORGE W. MILLER . . . *Editor*
498 Winspear Avenue, Buffalo, N. Y.

Available
Grease & Oil
Chemist

Address
E. C. PRALL
805 ELK ST.
FRANKLIN, PA.

(Continued from page 1)

ard car. At normal speeds on a level road, the slip in the Fluid Drive is between ½% and 1%, which gives an efficiency of operation higher than that of many parts of the car ordinarily thought of as being 100% efficient. Hence the slight penalty in economy at normal speeds, because of the ½% to 1% slip, is overcome by the increased economy of operation in traffic, when 80% to 90% of the driving is done in high gear.

3. Q. With no mechanical connection between the engine and the rear wheels, can you start the car by pushing?
   A. Yes. the Fluid Drive is just as efficient in either direction of drive; i. e., with the power supplied by the engine, or with the power coming from the rear wheels. It is merely necessary to lock up the overdrive unit and start the car by pushing at the same or slightly greater speed than the standard car.
4. Q. How often do you have to change the oil in the Fluid Drive unit?
   A. After hundreds of thousands of miles of operation of Fluid Drives in Chrysler Corporation Engineering test cars it has never been found necessary to change the oil. A periodic inspection of the oil level is all that is necessary, to check on the very slight seepage which might exist, and ordinarily the unit will require considerably less than ½ pt. after a year of hard service.
5. Q. How much oil does the Fluid Drive hold?
   A. The capacity is 2⅛ gal.
6. Q. What happens if the Fluid Drive is filled more than the 80% with which it is filled at the factory?
   A. It is impossible to fill the unit more than 80% full because there are no holes in the Fluid Drive housing through which it can be filled to more than 80%.
7. Q. Doesn't the oil sludge, and form varnish when the unit gets warm?
   A. No. It takes the combined effects of heat and oxygen to cause a breakdown of an oil, and since the Fluid Drive unit is completely sealed, no air or oxygen can get to the oil. The slight amount of air in the unit when originally filled does not contain sufficient oxygen to cause deterioration of the oil.
8. Q. Why don't you fill the Fluid Drive unit full of oil?
   A. Because it is necessary to allow for the expansion of the oil when it gets warm.
9. Q. Will the Fluid Drive work when the temperature goes way down below zero?
   A. The Fluid Drive will function satisfactorily at all anticipated extremes of temperature.
10. Q. If it is possible to do most of the driving in high gear, why is a transmission provided, and why is there a clutch?
    A. A transmission is provided for reverse, to obtain maximum acceleration by going through the gears when starting, for steep grades and getting out of chuck holes, and to provide a cruising gear for normal road speeds. Flashing performance to pass is provided by the step-down feature of the transmission. The clutch is necessary to disengage the engine from the rear wheels when changing gears.
11. Q. How much oil flows in the Fluid Drive unit?
    A. Oil circulation is greatest with the car standing still, in gear with the clutch engaged, and with the throttle wide open. Under these conditions the engine speed is approximately 850 r.p.m. and there are approximately 9 tons of oil flowing through the Fluid Drive unit every minute. The oil velocity under these conditions is approximately 21 ft. per second, or 14.3 m.p.h. The faster the car goes, the slower the oil in the Fluid Drive unit flows.
12. Q. In a car equipped with Fluid Drive, can the engine be used to brake the car, or is there a free-wheeling effect?
    A. As the Fluid Drive unit is equally efficient on drive and coast, the engine may be used to retard the forward motion of the car just as in a standard car equipped with a transmission overdrive.
13. Q. Is there anything new to learn in driving a car equipped with Fluid Drive?
    A. No. The car may be driven exactly as any standard car. However, much less gear shifting and clutch pedal operation is required in a car equipped with Fluid Drive.
14. Q. How does the Fluid Drive operate when the car is in reverse gear?
    A. There is no difference in operation of the Fluid Drive in forward or reverse gear. The Fluid Drive always turns forward, and the reverse drive is obtained in the transmission behind the Fluid Drive.
15. Q. What happens if the level of the fluid in the Fluid Drive should become low?
    A. While such an occurrence should be extremely rare, nothing of a serious nature will happen. The efficiency of the unit would be temporarily impaired, and this would be evidenced by excessive engine speeds.
16. Q. You use straight fins in the Fluid Drive unit. Why couldn't you obtain more efficient operation by using curved fins?
    A. For constant speed operation, a unit might be designed which would have an efficiency of perhaps ½% greater by the use of curved fins, but the efficiency at all other speeds would be less than if straight fins were used. Since the Fluid Drive unit must have a maximum efficiency at all speeds from 400 to 4000 r.p.m., the most efficient construction is to use exactly straight, radial fins.
17. Q. Isn't the Fluid Drive similar to the Fluid Flywheel as used on certain foreign cars for a number of years?
    A. In principle, yes. In construction, no. The major structural parts of the Fluid Drive are constructed entirely of strong stamped and forged steel pieces welded together in one inseparable unit. It is much stronger than the Fluid Flywheel as used on foreign cars, which is made of aluminum castings, always subject to porosity and cracks which might cause leaks. Also, these alu-

(Continued on page 4)

Spokesman ...t be Reprinted Without Special Permission.

(Continued from page 3)

minum castings are not as strong as steel and, due to the necessarily thick sections to obtain strength, the Fluid Flywheel is not so efficient as the Fluid Drive used on Chrysler cars.

18. Q. Isn't the Fluid Drive similar to the drive used on certain trucks and on buses in New York City?

A. No. The only similarity between the two is that each uses oil as a driving medium. In the units used in trucks and buses, there is more torque or driving force at the output shaft than at the input shaft, and this multiplication of torque involves a considerable loss, which makes the maximum efficiency approximately 85%, and makes necessary the addition of a device to lock the input and output members of the unit at ordinary driving speeds, thus sacrificing the cushioning qualities of a drive through oil. In the Fluid Drive there is no multiplication of torque through the unit, and there is exactly as much torque on the output shaft as there is on the input shaft. The maximum efficiency of the Fluid Drive unit is about 99½%, and this is approached at normal car speeds, making unnecessary any device to lock the input and output shafts together. Thus, the cushioning qualities of a drive through oil are obtained throughout the driving range in a car equipped with the Fluid Drive.

19. Q. Won't the fins be bent by the oil when it is moving at high velocity and with great force?

A. No. Since there are 22 fins on the driving member and 24 fins on the driven member, the load is equally divided between them, and the maximum load on any one fin is approximately 29 lb.

20. Q. Why do you use 22 fins on the driving member and 24 fins on the driven member?

A. In order to avoid any harmonic vibration which might be set up due to the periodic indexing of an equal number of fins in each member.

21. Q. Why is the performance of a car equipped with Fluid Drive greater than the performance of a similar car without Fluid Drive?

A. Because the Fluid Drive allows the engine to operate at speeds nearer its torque (driving force) peak for a greater speed range than the engine in a car not equipped with Fluid Drive. This advantage applies as well in all gears, first, second, direct, or overdrive.

22. Q. Why is the operation of a car equipped with Fluid Drive so superior to that of a car not equipped with Fluid Drive under slippery driving conditions? Why is it possible to start without skidding or spinning the rear wheels?

A. Under slippery driving conditions, such as snow, ice, mud, sand, loose gravel, etc., the friction or traction between the treads of the tires and the road surface is very much decreased. This means that the engine in the car is capable of applying much more driving force to the rear wheels than that necessary to cause the rear wheels to skid or spin. It is a well established engineering fact that the traction between a tire and a road surface is at a maximum when just slightly less turning force is applied to the rear wheels than that force necessary to cause the wheels to spin. As soon as the rear wheels spin, the traction immediately drops considerably below the traction present just before the wheels went into a spin.

Hence, in order to obtain the maximum traction at the rear wheels for starting, it is necessary to apply a force to the rear wheels considerably less than the force which would be applied in a standard car with the transmission in first or second gears with the accelerator pedal partly depressed. Thus, in a standard car under slippery road conditions it would be desirable to start in high gear. To do this, however, would require a very skillful manipulation of the clutch pedal in order to "feather" the clutch into engagement without stalling the engine or causing the rear wheels to spin. With a Fluid Drive, however, the maximum traction at the rear wheels may be obtained by placing the transmission in high gear, engaging the clutch, and then gradually pushing down on the accelerator pedal. As the engine speed increases, the Fluid Drive will apply more and more driving force to the rear wheels until a point is reached where the car will move away smoothly without any spinning or skidding of the rear wheels. No skill is required to start a car in this manner and even the most inexperienced driver may make smooth starts on slippery road surfaces without spinning or skidding the rear wheels.

When slowing down or accelerating under slippery driving conditions, also, the Fluid Drive eliminates the shocks to the rear wheels which have a tendency to make the car go into a skid, and hence the Fluid Drive at all car speeds makes the tendency to skid or spin the rear wheels much less.

Servicing the Fluid Drive

Because of the necessity of special service tools and a detailed knowledge of the assembly, any service operations performed on the Fluid Drive unit should be performed at an approved Chrysler Service Station.

The operation of the Fluid Drive is fully automatic and under normal conditions requires no attention other than an inspection of the oil level at the end of the first 500 miles and each 2,500 miles thereafter.

In conclusion, the Fluid Drive represents a practical solution to the problem of providing a car in which clutch pedal operation has been reduced to a minimum, and in which up to 95% of driving under ordinary conditions may be done in high gear.

Don't forget the

SEVENTH ANNUAL CONVENTION

•

STEVENS HOTEL
CHICAGO

•

OCTOBER 2 - 3